

Introduction

Travelers who will be visiting mountain areas should be prepared to recognize and respond to the symptoms of altitude illness, which are caused by the lower level of oxygen available at high elevations. Although the human body can adjust to changes in altitude, the process (called acclimatization) takes time. Acclimatization is not completely understood, although there is some evidence that suggests genetic factors might play a part in an individual's response to altitude.

Each person has their own "acclimatization line." Below it you probably won't experience altitude illness, but going above it causes symptoms to begin. For most people, this line initially lies somewhere near 9,000 feet (2,700 meters), but it can be adjusted by following preventive techniques.

Prevention

The simplest way to avoid or reduce the symptoms of altitude illness is to *ascend slowly* to give your body time to become accustomed to changes in oxygen concentration. It's also important to increase your fluid intake to counteract symptoms of dehydration induced by dry mountain air and increased respiratory rate.

Spending the night at or just below one's acclimatization line gives the body time to adjust. If you begin to feel symptoms of altitude illness, you are probably near your acclimatization line. Once you reach your acclimatization line, or an altitude of 10,000 feet (3,000 meters), it is best to keep your total daily altitude gain under 1,000 feet (300 meters). You can exceed 1,000 feet of altitude during the day's climb, but should descend to sleep at an altitude that is no more than 1,000 feet above the previous night's. Ascending during the day and descending partway for sleep will help you acclimatize more efficiently. Your acclimatization line adjusts, and most people can continue climbing the next day. This is the source of the maxim "*climb high, sleep low.*"

Recommendations

Symptoms of altitude illness occur during ascent, not descent. If a group tries to push past the limits of its individual climbers, there is a good chance that those who are most susceptible will experience symptoms of altitude illness. If you or a member of your party becomes ill during ascent, you should always assume the problem is due to altitude illness and act accordingly.

Keep a log of the altitude at which your trip begins, the amount gained each day and the altitude at which you sleep each night. If anyone becomes ill, this information will be very important.

Avoid using alcohol or any unnecessary medications, since their effects may be increased at high altitudes. Sleeping pills, tranquilizers and narcotic-based pain relievers, in particular, can cause serious problems at high altitudes because they can decrease breathing rate. Consult with your health care provider about any medications you plan to bring with you.

Three Types of Altitude Illness

1. **Acute mountain sickness (AMS)** typically appears at altitudes above 8,000 feet (2,400 meters), though illness can begin at elevations as low as 5,000 feet (1,500 meters) in some individuals. Symptoms usually appear within a few hours of ascent, and may include one or many of the following:

- headache
- insomnia
- irritability
- dizziness
- muscle aches
- fatigue
- loss of appetite
- nausea or vomiting
- swelling of the face, hands and feet

If you experience mild AMS symptoms, limit your activity level and remain at the same altitude for a day or two before resuming the climb. Aspirin or ibuprofen can be used for headache. If symptoms become worse during a day of rest, it is very important to descend until you begin to improve.

The sulfa drug acetazolamide¹ has been shown to prevent or lessen AMS symptoms by increasing breathing rate and helping with acclimatization. For prevention, 125-250 mg twice a day is commonly recommended, to be started the day before ascent and continued for several days at altitude. The same dose has been effective in treating AMS when given at the onset of symptoms and continued for 1 day after symptoms have cleared.

Dexamethasone² can improve symptoms long enough for severely ill climbers to descend to safety and medical help, but it is not curative and does not promote acclimatization. The dose typically recommended is 4 mg every 6 hours. It is not recommended for AMS prevention.

Depending on the severity of the illness, additional drugs and oxygen treatment may be necessary. Consult your health care provider or travel medicine specialist for specific recommendations about prevention and treatment.

2. **High Altitude Cerebral Edema (HACE)** can be thought of as a worsening of AMS symptoms, with the addition of changes in consciousness and/or a loss of coordination as intracranial pressure increases. Those affected may hallucinate, appear confused and begin to stumble or stagger. They can have severe headaches and incapacitating fatigue. This is a dangerous form of altitude illness, and it can lead to coma and death. Dexamethasone² (usually 4 mg every 6 hours) can often improve symptoms long enough for severely ill climbers to descend to safety and medical help, but it is not curative and does not promote acclimatization. *It is crucial for the victim to descend and receive drug and oxygen treatment.* Climbers need to watch each other for symptoms, since victims may be unable to grasp the problem. People who have experienced HACE should not be allowed to begin climbing again, even if they have improved.

3. **High Altitude Pulmonary Edema (HAPE)** is a buildup of fluid in the lungs that can occur along with HACE or as a separate illness. Like HACE, it is a medical emergency. Those affected will be breathless and very tired when walk-

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ing, and have a sense of fullness or pressure in the chest. Eventually victims will be short of breath even while resting. At this point the illness can rapidly progress to death. *Victims must be guided back down and receive drug and oxygen treatment as soon as their illness is recognized as HAPE.* They should be kept warm and assisted as much as possible, since exertion will make their condition worse. Drug treatment often includes 10 mg of Nifedipine³ every 8 hours to reduce pressure in the pulmonary artery. Some people have chosen to ascend again after recovering from HAPE, but this is not recommended.

Danger signs include severe headache, extreme fatigue or breathlessness (especially while resting), and any neurological problems such as stumbling, confusion, poor judgment or changes in consciousness.

It is crucial to descend until symptoms begin to diminish if these signs are present.

Flying or Driving to High Altitudes

Flying or driving directly to a mountain destination does not allow the human body enough time to adjust to the altitude. Every attempt should be made to plan your trip to include days spent at transitional altitudes. If you are flying or driving to a high-altitude location, consult with your health care provider before you leave and discuss your need for medications to prevent and/or treat altitude illness. And remember, the same advice that applies to climbers applies to anyone at a high altitude: watch for signs of altitude illness, drink extra water, don't do too much too fast, and avoid alcohol and unnecessary medications, especially those that decrease breathing rate such as sleeping pills, tranquilizers and narcotic-based pain relievers.

Health Conditions

There is a good chance that those who have had altitude illness once will have it again at high elevations. If you have had altitude problems previously, if you have heart or lung problems, or if you are planning to go to extremely high altitudes, consult your health care provider to discuss your options for prevention and treatment of illness.

Endnotes

1. Acetazolamide may cause tingling in hands and feet or nausea in some people. It is commonly used as a diuretic, and will usually increase urination. It should not be used by those with allergies to sulfa drugs, with kidney or liver disorders, on high-dose aspirin therapy, or by women who are pregnant or nursing. Always consult your health care provider for specific recommendations.
2. Dexamethasone is a steroid, commonly used to reduce inflammation. Since its use in altitude illness is usually of short duration, side effects caused by prolonged steroid use do not usually apply. If used for over 10-14 days, it may cause changes in blood sugar, blood pressure, immune

system function and thought processes. Always consult your health care provider for specific recommendations.

3. Nifedipine improves blood flow and reduces the need for oxygen. It is commonly used to relieve heart pain and hypertension. It can cause a drop in blood pressure, which typically makes people feel weak and dizzy. It can also cause headache, nausea, dizziness, and swelling of the legs in some people. It should not be used by women who are pregnant or nursing. Always consult your health care provider for specific recommendations.